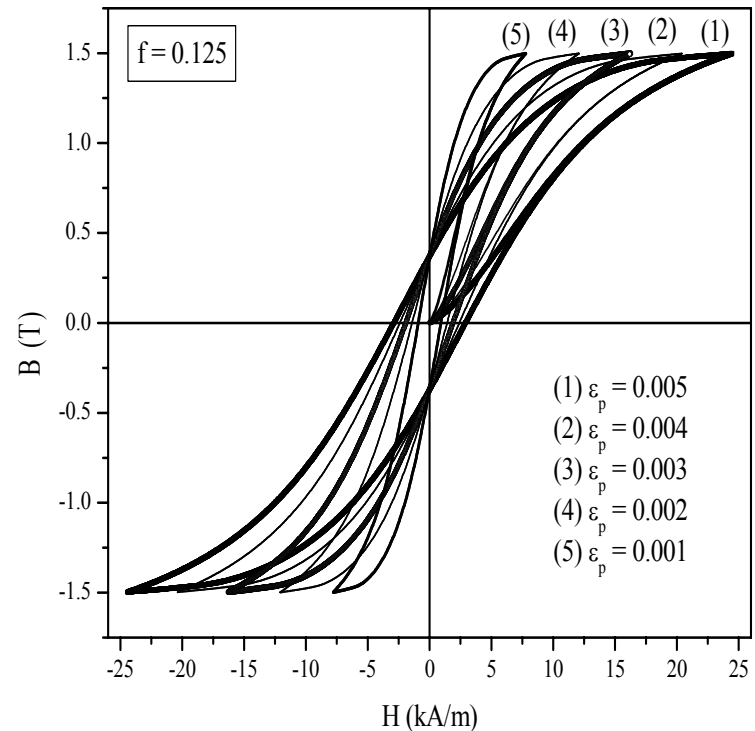


# Modeling and Testing the Effects of Texture and Plastic Deformation on Magnetic Properties

M.J.Sablik, SwRI & C.J.Gutierrez, TxStU **DMR-0306108**

As part of the InterAmerican Materials Collaborative program, this research program joins an established magnetic hysteresis modeler and a magnetic thin films expert with a metallurgist working on bulk magnetic materials in Brazil. The aim is to develop a physical understanding of the effect of plastic deformation and texture anisotropy on magnetic properties of ferromagnetic polycrystalline materials, both in bulk and film form, and also to develop quantitative hysteresis models that predict such magnetic properties. First year modeling will be published in Sept. 2004 issue of IEEE Trans.Magn.



. Computed hysteresis plots for different amounts of tensile plastic deformation, from 0.1% to 0.5%. The slope of the hysteresis loop decreases and the coercivity increases with increasing plastic strain.

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The magnetic film effort is underway. Films are being made using radical assist-dual ion beam sputtering (RA-DIBS). Various collaborations are facilitating extraction of dislocation density from XRD data to assist hysteresis modeling. A tensile stressing apparatus is being used in combination with a superelastic nitinol substrate to produce plastic film stress. A sensitive, donated Lakeshore 7304 VSM is being used for hysteresis measurements.

## **Education:**

Two undergraduates (J. Garcia, and J.Contreras), 3 graduate students ( S. Rios, C.Smith and S.Fritz), and one postdoc (A. Bandyopadhyay) have contributed to this work.

## **Outreach:**

Postdoc Taeko Yonamine, a physicist from IPT in Sao Paulo, Brazil visited SwRI for six weeks. Dr. Yonamine was supported by Dr. Fernando Landgraf, a metallurgist working on bulk magnetic materials. Dr. Yonamine assisted with modeling plastic deformation effects on magnetic properties. In April, Dr. Sablik traveled to Brazil to interact with Dr. Landgraf's group. A graduate student, S.Rios, from Texas State Univ. also worked at SwRI on modeling and in August traveled to Brazil to interact with Dr. M. de Campos on extracting dislocation density from XRD. While Dr. Sablik was in So. America, he went to a conference in Chile to present project modeling work, which he later presented in Poland at a second conference.